FOOTWEAR CLOSURE SYSTEM WITH ZONAL LOCKING

INVENTOR
John Dietrich Martin

FIELD OF THE INVENTION

This invention relates generally to footwear and, more specifically, to a system and method for adjustably securing the footwear to a wearer's foot.

BACKGROUND OF THE INVENTION

Over the last few decades, different ways of closing and securing footwear have been developed. Historically, footwear was designed to slip onto the foot or would be closed with one of laces or a buckling strap. However, with increased popularity of sports, consumers' investment in athletic shoes has resulted in additional techniques for footwear closure and securing systems. For example, athletic shoes were introduced with multiple Velcro® straps for closing the shoes. Also, shoes were introduced with inwardly-directed air bladders which the wearer could adjustably size with a built-in pumping device to custom-fit the shoe. Footwear manufacturers introduced variations on these closure systems and other devices to provide advantages to those selecting their footwear.

Another closure advancement introduced more recently to athletic shoes is a zonal-adjustable closure system. It was recognized that the wearer of an athletic shoe may, for example, desire a tight fit in the ankle to provide additional support while leaving the mid-foot area more loosely secured for comfort. Conversely, the wearer may want the shoe tightly secured to his or her foot while leaving his or her ankle loosely bound for freedom of movement. Unfortunately, with a conventional lacing system, even if the wearer tightly laces one section of the shoe's upper while leaving another section of the upper less tightly secured, that desired fitting is not likely to last. Tension in the laces in the more tightly secured part of the shoe will pull the looser sections of the lacing until the tension throughout

the entire lace is approximately equal. As a result, the tightness of the shoe will be approximately equal across all the zones of the shoe.

Various mechanisms have been devised to prevent laces from slipping between parts of a shoe to facilitate zonal tightening of the laces. For example, U.S. Patent No. 4,538,367 to Adams provides double-loop eyelets disposed between lower and upper vamp sections of a shoe. The double-loop lace eyelets operate in the nature of a traditional camp belt, wherein the lace is threaded through both loops then wrapped tightly back over a first loop and under a second loop. Once the lace is drawn tight, the lace is pinched between the first and second loops so it cannot slide through the eyelet. As a result, the double-loop eyelets prevent the lace from slipping and thereby prevent loosened lacing on one side of the double-loop lace eyelet from being tightened by more tightly drawn lacing on the other side of the double-loop lace eyelet. Similarly, U.S. Patent No. 5,214,863 to Skaja employs locking eyelets having eyelet openings and narrowing, elongate locking slots to facilitate zonal tightening. The shoe is laced to a desired tension below the locking eyelets and the laces are pulled into the narrowing, elongate locking slots of the locking eyelets. The locking eyelets pinch the laces to prevent the laces from moving through the eyelets. As a result, the locking eyelets prevent tightened lacing on one side of the locking eyelets from being loosened by drawing slack from the less tightly drawn lacing on the other side of the locking eyelets and vice versa.

Currently used zonal tightening systems, however, are not optimal or suitable for all applications. To name one example, snowboard boots suitably are secured using a cable instead of a lace because the less stretchable cable is desirable to ensure rigid support of the boot to allow the wearer to control the attached snowboard. Known locking systems, such as Adams's double-loop eyelets are not suitable because it is neither practical nor desirable to bend the cable closure of the boot through the two eyelets to facilitate zonal tightening of the cable. Similarly, it is neither practical nor desirable to pull and/or bend the cable through a system such as Skaja's elongate locking eyelets which can kink or damage the cable closure.

Thus, there is an unmet need in the art for a zonal tightening system which can rigidly lock a cable closure or other lace closure without having to excessively bend or kink the closure.

SUMMARY OF THE INVENTION

Embodiments of the present invention provide systems and methods for zonal locking of an article of footwear. Embodiments of the present invention use at least one rotatable locking member to frictionably secure a closure line used to secure the tightness of the closure line between zones of the article of footwear. The rotatable locking member allows tension in the closure line to remain different on opposing sides of the locking member.

Also, the rotatable locking member allows the closure line to be locked without kinking or bending the closure line at an acute angle at any point along the line. As a result, the rotatable locking member is particularly advantageous for cable closure lines which practically cannot or should not be bent at acute angles.

More specifically, embodiments of the present invention provide zonal locking for an article of footwear having a first zone and a second zone. At least one curving point is disposed between a first zone and a second zone of the article of footwear, the curving point being configured so that a closure line curves around the curving point to turn a line of travel of the closure line without bending any single point of the closure line at an acute angle. At least one rotatable closure line lock is configured to move into a locking position wherein the closure line lock frictionably engages the closure line to generally prevent the closure line from moving through the curving point to allow a first tension in the closure line in the first zone to remain different than a second tension in the closure line in the second zone.

In accordance with one embodiment of the present invention, the curving point includes a rotatable cylinder mounted between the first zone and the second zone. The rotatable cylinder has an outer surface configured to windably receive the closure line and frictionably engage the closure line so that the closure line generally cannot be moved without rotating the rotatable cylinder. The rotatable cylinder includes a control grip allowing the wearer to adjust at least one of the first tension in the closure line and the second tension in the closure line. The closure line lock includes a cylinder lock configured to selectively prevent the rotatable cylinder from rotating. The closure line lock, for one example, includes a slidable cylinder mount allowing the rotatable cylinder to move along an axis of rotation having a first position wherein the rotatable cylinder can be rotated and a second position wherein the rotatable cylinder cannot be rotated.

In accordance with another embodiment of the present invention, the system includes at least two curving points disposed on opposing sides of a body-receiving opening in the article of footwear. Each of the curving points includes a closure line guide opening configured to receive at least one closure line lock and a locking base configured to frictionably engage the closure line when the closure line lock is rotated into the locking position. The closure line lock includes a hinge fixably mounted adjacent the closure line opening and having an axis generally parallel with the closure line as the closure line passes through the closure line guide opening. A cam lever rotatably mounted on the hinge and having a radially expanding lobe is configured so that when the cam lever is rotated into a locked position, a surface of the radially-expanding lobe frictionably secures the closure line against the locking base.

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Seattle, Washington 98104
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In accordance with other aspects of the present invention, the closure line suitably includes a cable. Furthermore, the system can be disposed either on a boot shell or on a boot liner. In addition, the system can include at least one additional zone adjacent either the first zone or the second zone. An additional curving point and closure lock are used to allow for a closure line tension in an additional zone to remain different from the closure line tension in an adjacent zone.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIGURE 1A is side view of a snowboard boot using a first embodiment of the present invention;

FIGURE 1B is a partial top view of a closure of the snowboard boot of FIGURE 1A;

FIGURE 2 is a top cutaway view of a curving point and cam lock configured to secure a closure line;

FIGURE 3A is a cross-sectional side view of the curving point and cam lock of FIGURE 2 in an unlocked position;

FIGURE 3B is a cross-sectional side view of the curving point and cam lock of FIGURE 2 in a locked position;

FIGURE 4 is a top view of a closure of a snowboard boot using a second embodiment of the present invention;

FIGURE 5 is a perspective schematic view of a rotatable cylinder zonal lock configured to secure a closure line in an unlocked position; and

FIGURE 6 is a flowchart of a routine according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

By way of overview, embodiments of the present invention provide zonal locking for an article of footwear having a first zone and a second zone. At least one curving point is disposed between a first zone and a second zone of the article of footwear, the curving point being configured so that a closure line winds around the curving point to turn a line of travel of the closure line without bending any single point of the closure line at an acute angle. At least one rotatable closure line lock is configured to move into a locking position wherein the closure line lock frictionably engages the closure line to generally prevent the closure line from moving through the curving point to allow a first tension in the closure line in the first zone to remain different than a second tension in the closure line in the second zone.

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FIGURE 1A is a side view of a snowboard boot 100 using a first embodiment of the present invention. Embodiments of the present invention are well-suited for a snowboard boot 100 because the wearer may desire a different tightness of the boot 100 in a first section 110 of the boot 100, such as a section over the foot of the wearer, than in a second section 120 of the boot, such as a section over the ankle or lower leg of the wearer. For example, the wearer may desire a lesser degree of tightness of the boot 100 in the first section 110 for comfort while the wearer desires a higher degree of tightness in the second section 120 to provide greater support and increased control of the snowboard, or vice versa. To provide for different degrees of tightness between the first section 110 and the second section 120 of the snowboard boot 100, the snowboard boot 100 is equipped with a zonal lock 130 according to a first embodiment of the present invention.

Although a snowboard boot 100 is shown in FIGURE 1, it will be appreciated that embodiments of the present invention can be adapted for use with any other type of footwear. For example, a high-topped basketball shoe can incorporate an embodiment of the present invention to allow a player to lace his or her shoe more loosely in the foot section for comfort and more tightly in the ankle section for greater support, or vice versa. Embodiments of the present invention are not limited to snowboard boots, ski boots, boots, or athletic shoes, as any type of footwear can benefit from an embodiment of the present invention.

In addition, FIGURE 1 depicts footwear having two zones, a first zone 110 and a second zone 120, separated by a single zonal lock 130. However, it will be appreciated that one or more additional zones could be added to provide for more than two zones having different degrees of tension in the closure line. An additional zone could be added adjacent to either the first zone 110 or the second zone 120 and separated from the adjacent zone by an additional zonal lock 130. Thus, for example, the boot 100 could include a first zone at the wearer's mid-foot, a second zone at the wearer's heel, and an additional zone at the wearer's ankle. Any number of additional zones can be added by including an additional zonal lock to set off each additional zone.

FIGURE 1B is a top view of a closure 140 of the snowboard boot 100 of FIGURE 1A. The closure 140 is a closable opening in an upper of a boot shell, boot liner, or other footwear, such as an opening that is secured over a tongue across a top of the wearer's foot or lower leg. The closure 140 includes a closure line 150 allowing the closure 140 to be closed to secure the boot 100 on the wearer's foot and ankle. The closure line 150 suitably is a cable, a lace, or another suitable form of cord. The closure line 150 engages securing points 160 on opposing sides of the closure 140 so that, when tension is applied to the closure line 150, the closure is secured to the user's foot.

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The closure 140 (FIGURE 1B) includes the zonal lock 130 to enable a closure line 150 to maintain a first degree of tension in the first zone 110 different from a second degree of tension in the second zone 120. More specifically, the zonal lock 130 frictionably secures the closure line 150 in place to allow a different degree of tension to be maintained in the closure line 150 on opposing sides of the zonal lock 130. The zonal lock 130 includes a curving point 180 engaging the closure line 150 similarly to how the securing points 160 engage the closure line. However, the zonal lock also includes a rotatable lock 190 configured to enable the zonal lock to frictionably engage the closure line 150 to permit different degrees of tension on opposing sides of the zonal lock 130.

As shown in FIGURE 1B, the zonal lock 130 is shaped with a curving point 180 channeling the closure line 150 without bending a single point on the closure line 150 without kinking or bending the closure line 150 at an acute angle. Not sharply bending the closure line 150 is desirable when the closure line is a cable or any other type of lace that could be damaged by sharp bending of the cable. In addition, even using a flexible closure line 150 such as a woven lace, avoiding sharp bending of the closure line allows the closure line 150 to be drawn more readily through the zonal lock 130 until it is desired that the closure line 150 be locked in place.

FIGURE 2 is a top cutaway view of the zonal lock 130 showing the curving point 180 and the rotatable lock 190 for securing the closure line 150. A base 200 of the curving point 180 is secured to the shoe upper on opposing sides of the closure 140. The curving point 180 channels the closure line 150 around curved corners 210 so that the travel of the closure line 150 can be turned without sharply bending the closure line 150 as previously described. As the closure line 150 passes through the curving point 180, the rotatable lock 190 secures the closure line 150. The rotatable lock 190 is a cam lock that rotates about a hinge which, for example, may be integrated into the base 200 of the curving point 180. Moving the rotatable cam lock 190 into place frictionably engages the closure line 150 between the cam lock 190 and the curving point 180.

FIGURE 3A is a cross-sectional side view of the closure line 150, the curving point 180, and the cam lock 190 of FIGURE 2 in an unlocked position. The closure line 150 passes against a locking base 250 presented by the curving point 180. The locking point 150 laterally engages the closure line 150 from an inward side of the closure 140 (FIGURE 1B) so that the closure 140 is drawn closed when tension is applied to the closure line 150.

The cam lock 190 includes a lever arm 300 for rotating a radially-expanding lobe 310 about a hinge 320. An axis of the hinge 320 is generally parallel to the closure line 150 as it passes the cam lock 190. The cam lock 190 is rotated about the hinge 320 into a locked

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Seattle, Washington 98104
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position by turning the lever arm 300, as shown in FIGURE 3A, in a counterclockwise direction. As the cam lock 190 is rotated into the locked position, a surface 330 of the radially-expanding lobe 310 presses the closure line 150 against the locking base 250, locking the closure line 150 in place as is shown in FIGURE 3B.

FIGURE 3B is a cross-sectional side view of the closure line 150, the curving point 180, and the cam lock 190 of FIGURE 2 in a locked position. In the locked position, the surface 330 of the radially-expanding lobe 310 of the cam lock 190 presses the closure line 150 against the locking base 250. The combined lateral force of the cam lock 190 and the locking base 250 against the closure line 150 frictionably locks the closure line 150 in place. To adjust or readjust the tension in the closure line 150, the lever arm 300, as shown in FIGURE 3B, is turned in a clockwise direction. Rotating the cam lock 190 in a clockwise direction retracts the surface 330 of the radially-expanding lobe 310 of the cam lock 190, thereby allowing the closure line to move freely.

FIGURE 4 is a top view of a closure 400 of a snowboard boot using a second embodiment of the present invention. Once again, the closure 400 is a closable opening in an upper of a boot shell, boot liner, or other footwear, such as an opening that secured over a tongue across a top of the wearer's foot or lower extremity. The closure 400 includes a closure line 410 allowing the closure 400 to be closed to secure a boot or other article of footwear (not shown) on the wearer's foot and ankle. The closure line 410 suitably is a lace or a cable. The closure line 410 engages securing points 420 on opposing sides of the closure 400 so that, when tension is applied to the closure line 410, the closure is secured to the user's foot.

As in the case of the first embodiment of the present invention, a second embodiment of a zonal lock 430 enables the closure line 410 to maintain a first degree of tension in the first zone 440 different from a second degree of tension in the second zone 450. More specifically, the zonal lock 430 frictionably secures the closure line 410 in place to allow a different degree of tension to be maintained in the closure line 410 in the first zone 440 and the second zone 450 on opposing sides of the zonal lock 430.

FIGURE 5 is a perspective schematic view of the zonal lock 430. The zonal lock 430 includes a curving point 500 in the nature of a rotatable cylinder. The closure line 410 wraps around an outer surface of the rotatable cylinder 500. As tension is applied to the closure line 410, the outer surface of the rotatable cylinder 500 frictionably engages the closure line 410. When the rotatable cylinder 500 frictionably engages the closure line 410, the closure line 410 cannot be moved without moving the rotatable cylinder 500. Thus, securing the rotatable cylinder 500 allows different degrees of tension to be controllably maintained in the

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closure line 410 on opposing sides of the zonal lock 430, thereby allowing for different degrees of tension in the closure line 410 in zones 440 and 450 on opposing sides of the zonal lock 430.

The rotatable cylinder 500 is rotatably mounted on a mounting base 510. An axle 520 provides rotatable engagement between the mounting base 510 and the rotatable cylinder 500. The axle 520 suitably is fixably mounted to the mounting base 510 and rotatably mounted to the rotatable cylinder 500, rotatably mounted to the mounting base 510 and fixably mounted to the rotatable cylinder 500, or rotatably mounted to both the mounting base 510 and the rotatable cylinder.

A locking mechanism 530 is operable to prevent the rotatable cylinder 500 from rotating relative to the mounting base 510. The locking mechanism 530 can include a number of locking techniques. For example, the locking mechanism 530 suitably is a cam lock for frictionably engaging an end of the rotatable cylinder 500. Alternatively, the rotatable cylinder 500 can be movable transversely along the axis 520 and the rotatable cylinder 500 and the mounting base can be fitted with fixed interlocking gears or teeth. In such an embodiment, pushing the rotatable cylinder 500 against the mounting base 510 engages the interlocking gears or teeth, thereby preventing the rotatable cylinder from rotating relative to the base in a down and locked position. Similarly, a base of the axle 520 can be fitted with radially-extending teeth to engage inward-facing teeth inside an annular surface of the rotatable cylinder to lock the rotatable cylinder in a down and locked or up and locked position. Any suitably rotation locking technology can be used to prevent the rotatable cylinder from rotating when it is desired to lock the zonal lock 430.

Also, the rotatable cylinder 500 of the zonal lock 430 is desirably equipped with a gripping ring 540 at a distal end of the rotatable cylinder 500. The gripping ring 540 facilitates a wearer being able to turn the rotatable cylinder 500 when it is in an unlocked position to be able to adjust tension in the closure line 410 in a zone 440 and 450 on either side of the zonal lock 430. As in the case of the first embodiment of the invention (FIGURES 1A – 3B), one or more additional zones could be added to provide for more than two zones having different degrees of tension in the closure line. An additional zone can be added adjacent to either the first zone 440 (FIGURE 4) or the second zone 450 and separated from the adjacent zone by an additional zonal lock 430.

FIGURE 6 is a flowchart of a routine 600 for using a single zonal lock 130 (FIGURES 1B-3B) and 430 (FIGURES 4 and 5) to maintain zonal tightening and locking of two zones of an article of footwear. It will be appreciated that the routine 600 suitably is

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extended to allow for use of additional zonal locks facilitating creational of additional, separately controllable tightening zones as desired.

The routine begins at a block 610 with a wearer beginning to fit the footwear by placing his or her foot into the footwear. At a block 620, tension of a closure line is adjusted in a first zone of the article of footwear. In accordance with previously described embodiments of the present invention, the tension suitably is adjusted according to the first embodiment by pulling the closure line to a desired tightness. In accordance with a second embodiment of the invention, the tension suitably is adjusted by pulling a closure line until it frictionably engages the zonal lock and further adjusted by rotating the rotatable cylinder 500.

At a decision block 630, it is determined if the tension in the first zone has reached a desired level. If not, the routine 600 reverts to the block 620 for further adjustment of the tension. On the other hand, if it is determined at the decision block 630 that a desirable level of tension has been reached, at a block 640 a rotatable lock such as the cam lock or lockable rotatable cylinder is moved into a locked position to maintain the desired tension in the first zone.

At a block 650, tension in the closure line can be adjusted to a desired level in a second zone and the closure line can be secured. At a decision block 660, it is determined if changes in fit or tension of the article of footwear are desired. If so, at a block 670, the rotatable lock is moved into an unlocked position to release the closure line. The routine 600 then reverts to the block 620 where the wearer can further adjust the degree of tension in the closure line. However, if it is determined at the decision block 660 that a desired degree of tension has been reached, the routine ends at a block 680 with the ending of the fitting of the article of footwear. It will be appreciated that a wearer can repeat the routine as often as desired to adjust or change the zonal fitting of the article of footwear.

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the invention should be determined entirely by reference to the claims that follow.

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Seattle, Washington 98104
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